ferro-manganese addition without allowing the bath time for reaction throughout, or for degasification, it can happen that the reaction still continues its course in the ladle; but the powerful disturbance which the metal in the ladle undergoes in consequence of the infalling stream itself exercises at least an increased elimination of the mechanically mixed gases, and then the metal in the ladle can froth up, and this suddenly appear too small to contain the amount. The same action can occur once again on running into the moulds, the smaller section of which, and the simultaneously appearing influence of greater chilling, can then become the cause that the gas makes the metal in a moment to froth up to the brim of the mould, whereon it immediately sinks back again deeply. Such phenomena have been formerly very frequently observed, and they admit of being avoided in open-hearth steel if care is taken by means of a correct composition of the slag that the metal does not obtain an opportunity of taking up large amounts of oxygen, and if deoxidation takes place in the furnace itself and the metal is allowed time before tapping to throw off amounts of gas evolved by any possibility.

Manganese is without influence on the gases already present in the metal.

Other reducing agents to bring about deoxidation have been experimented with, but their use has been discontinued.

Silicon has proved itself unsuitable on many grounds. Its action on the oxygen is at once much feebler than that of manganese, and therefore for attainment of an equal action a much greater excess must be employed. The product of oxidation, silica, is, according to Ledebur ("Eisenhuttenkunde," Vol. III., p. 11), retained by the metal in the state of line division, and therefore prejudices the forgeability. The excess of Si which remains in the metal in addition reduces the forgeability.

Aluminium acts on the oxygen in iron more energetically than manganese, but it cannot replace the good properties of the latter for the further working. In addition, its employment has disadvantages as a consequence ; it makes the iron viscous, even with small additions, and increases the contraction so that the disposition to formation of cavities on solidification is greater.